

UNCLASSIFIED

AD NUMBER

AD813758

NEW LIMITATION CHANGE

TO

**Approved for public release, distribution
unlimited**

FROM

**Distribution: Further dissemination only
as directed by Air Force Materials
Laboratory, Wright-Patterson AFB, OH
45433, 04 FEB 1985, or higher DoD
authority.**

AUTHORITY

afwal per dtic form 55

THIS PAGE IS UNCLASSIFIED

UNCLASSIFIED

AD NUMBER

AD813758

NEW LIMITATION CHANGE

TO

Distribution: Further dissemination only as directed by Air Force Materials Laboratory, Wright-Patterson AFB, OH 45433, 04 FEB 1985, or higher DoD authority.

FROM

Distribution authorized to U.S. Gov't. agencies and their contractors; Critical Technology; MAR 1967. Other requests shall be referred to Air Force Materials Laboratory, Wright-Patterson AFB, OH 45433.

AUTHORITY

afwal/glist 4 feb 1985

THIS PAGE IS UNCLASSIFIED

UNANNOUNCED

AFML TECHNICAL LIBRARY
OFFICIAL FILE COPY

①

AD-813758

MECHANICAL-PROPERTY DATA 7039 ALUMINUM

Plate (T6151 Condition)

Issued by

DISTRIBUTION STATEMENT F: Further dissemination only as directed
by AFMRL/RTD or higher DoD authority. 4 FEB 1985
45433-6523

Air Force Materials Laboratory
Research and Technology Division
Air Force Systems Command
Wright-Patterson Air Force Base, Ohio

March, 1967

Prepared by

Battelle Memorial Institute
Columbus Laboratories
Columbus, Ohio 43201

DTIC FILE COPY

AF 33(615)-2494

DTIC
FEB 04 1985

D

E

85 01 25 028

This data sheet was prepared by Battelle Memorial Institute under Contract AF 33(615)-2494. The contract was initiated under Project No. 7381, "Materials Application", Task No. 738106, "Design Information Development". The major objectives of this program are to evaluate newly developed structural materials of potential Air Force weapons-system interest and then to provide data-sheet-type presentations of mechanical data. The program was assigned to the Structural Materials Engineering Division at Battelle under the supervision of Mr. Walter S. Hyler. Project engineer was Mr. Omar Deel. The program was administered under the direction of the Air Force Materials Laboratory, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, by Mr. Marvin Knight, project engineer.

Notices

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may be in any way related thereto.

Qualified requesters may obtain copies of this data sheet from the Defense Document Center, Washington, D. C.

~~This document is subject to special export controls and each transmittal to foreign governments or foreign nationals may be made only with the prior approval of the Materials Application Division (MAAM), AFML, Wright-Patterson Air Force Base, Ohio.~~

7039 Aluminum

Alloy 7039 is a recently developed heat-treatable, weldable aluminum alloy. The alloy was developed primarily for armor-plate applications; however, its high strength, weldability, formability, toughness, and corrosion resistance suggest it is suitable for cryogenic applications, missiles, and other structural applications where these properties are of importance.

Alloy 7039 is commercially available in plate, forgings, and extrusions. Sheet is available upon special inquiry.

7039 ALUMINUM DATA(a)

Condition: -T6151

Thickness: 1.00-inch plate

Properties	Temperature, F				
	-320	-105	RT	300	500
<u>Tensile</u>					
F _{tu} (longitudinal), ksi	79.5	65.5	58.8	41.9	--
F _{tu} (transverse), ksi	78.3	65.1	58.2	41.7	--
F _{ty} (longitudinal), ksi	58.9	51.8	48.6	41.0	--
F _{ty} (transverse), ksi	58.1	51.3	47.9	40.4	--
e _t (longitudinal), percent in 2 in.	20.3	16	17	33	--
e _t (transverse), percent in 2 in.	18	17	16	31	--
RA (longitudinal), percent	26.9	31.7	38.8	62.2	--
RA (transverse), percent	24.9	30.3	35.8	55.8	--
E _t (longitudinal), 10 ⁶ psi	11.7	11.0	10.2	9.5	--
E _t (transverse), 10 ⁶ psi	11.8	11.3	10.3	9.5	--
<u>Compression</u>					
F _c (longitudinal), ksi	56.9	50.4	47.5	41.4	--
F _c (transverse), ksi	60.5	53.1	50.6	42.6	--
E _c (longitudinal), 10 ⁶ psi	11.1	10.4	11.1	9.3	--
E _c (transverse), 10 ⁶ psi	12.1	10.5	10.3	9.9	--
<u>Impact (V-notch Charpy)</u>					
(Longitudinal), ft-lb	9.2	U ^(b)	12.7	16.2	--
(Transverse), ft-lb	6.0	U	9.0	10.8	--
<u>Fracture Toughness^(c)</u> , K _{Ic} , ksi $\sqrt{\text{in.}}$	U	U	48.2	(c)	--

(6 pp)(5 fig.) (tbis..) () ref.)

7039 ALUMINUM DATA (Continued)

Properties	Temperature, F				
	-320	-105	RT	300	500
<u>Shear(d)</u>					
F_{su} (longitudinal), ksi	U	U	33.7	U	--
F_{su} (transverse), ksi	U	U	31.9	U	--
<u>Axial Fatigue (Transverse)</u>					
Unnotched, $R = 0.1(e)$					
10^3 cycles, ksi	90	U	61	52	--
10^5 cycles, ksi	71	U	48	46	--
10^7 cycles, ksi	56	U	38	38	--
Notched, $K_t = 3.0(e)$, $R = 0.1$					
10^3 cycles, ksi	73	U	58	53	--
10^5 cycles, ksi	34	U	17.5	20	--
10^7 cycles, ksi	18	U	10	11	--
<u>Creep (Transverse)</u>					
0.5% elongation 100 hr, ksi	--	--	NA(b)	24	3.8
0.5% elongation 1000 hr, ksi	--	--	NA	19	2.7
<u>Stress Rupture (Transverse)</u>					
Rupture 100 hr, ksi	--	--	NA	28	5.4
Rupture 1000 hr, ksi	--	--	NA	21	3.7
<u>Stress Corrosion</u>					
80% F_{ty} , 1000 hr max.	--	--	No cracks(f)	U	U
<u>Coefficient of Thermal Expansion(g)</u>					
68-212 F = 13.0×10^{-6} in./in./F					
<u>Density(g)</u> 0.0988 lb/in. ³					
(a) Data are average of triplicate tests conducted at Battelle under the subject contract unless otherwise indicated. Fatigue, creep, and stress-rupture values are from data curves generated from the results of a greater number of tests.					
(b) U, unavailable; NA, not applicable.					
(c) Fatigue-cracked single-edge-notched specimen (1 x 2 x 18 inch) tested in bending under four-point loading. No pop-in detected at 300 F.					
(d) Double shear (1/4-inch pin).					
(e) "R" represents the algebraic ratio of the minimum stress to the maximum stress in one cycle; that is, $R = S_{min}/S_{max}$. "K _t " represents the Neuber-Peterson theoretical stress-concentration factor.					
(f) Alternate immersion, 3-1/2 percent NaCl. 3-point loading bend test.					
(g) Values from "Aluminum Alloy 7039", Kaiser Aluminum Brochure (June, 1965).					

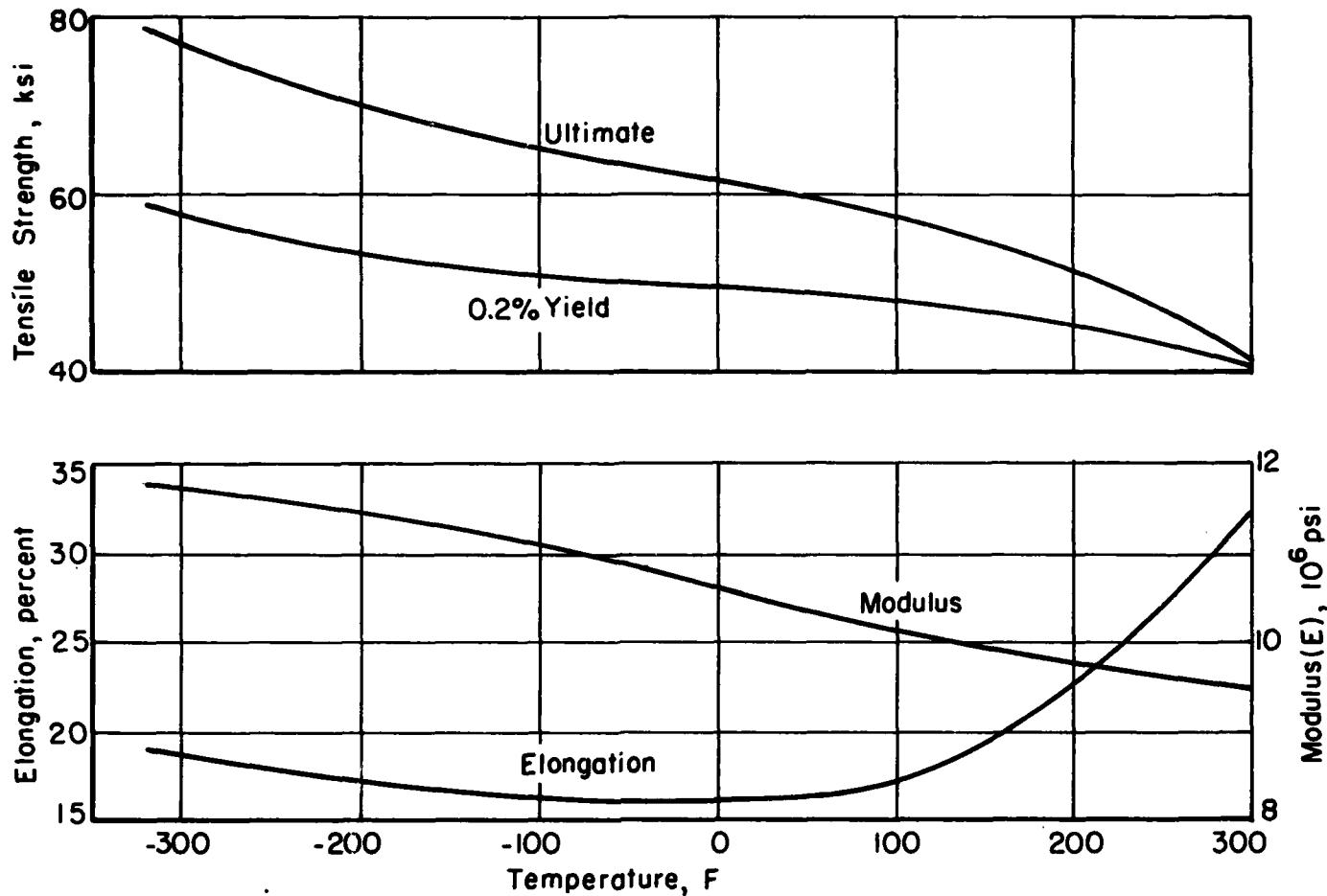


FIGURE 1. EFFECT OF TEMPERATURE ON THE TENSILE PROPERTIES OF 7039-T6151 ALUMINUM ALLOY PLATE

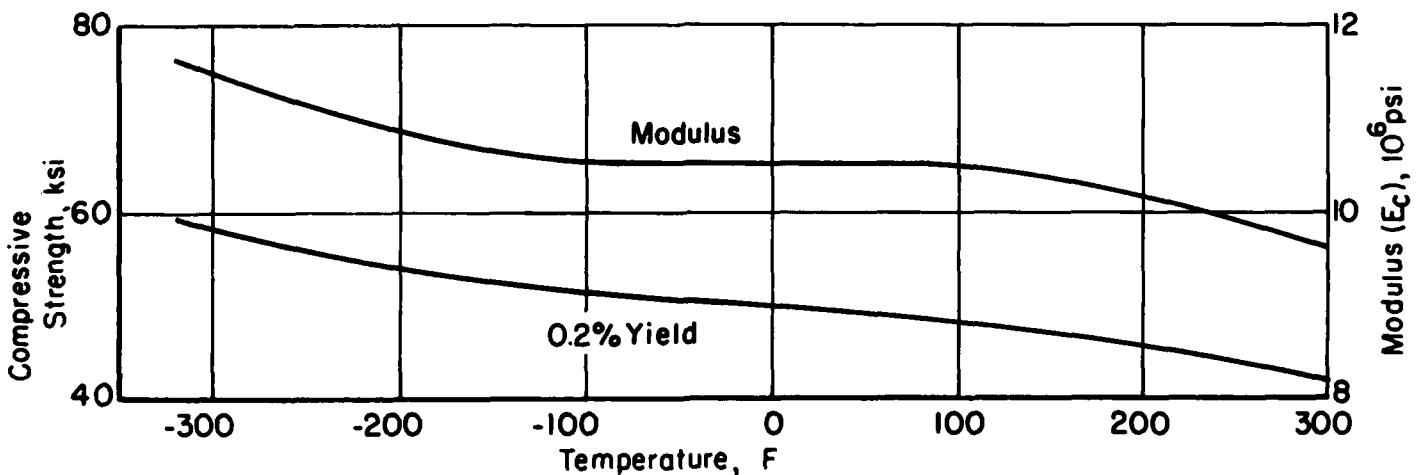


FIGURE 2. EFFECT OF TEMPERATURE ON THE COMPRESSIVE PROPERTIES OF 7039-T6151 ALUMINUM ALLOY PLATE

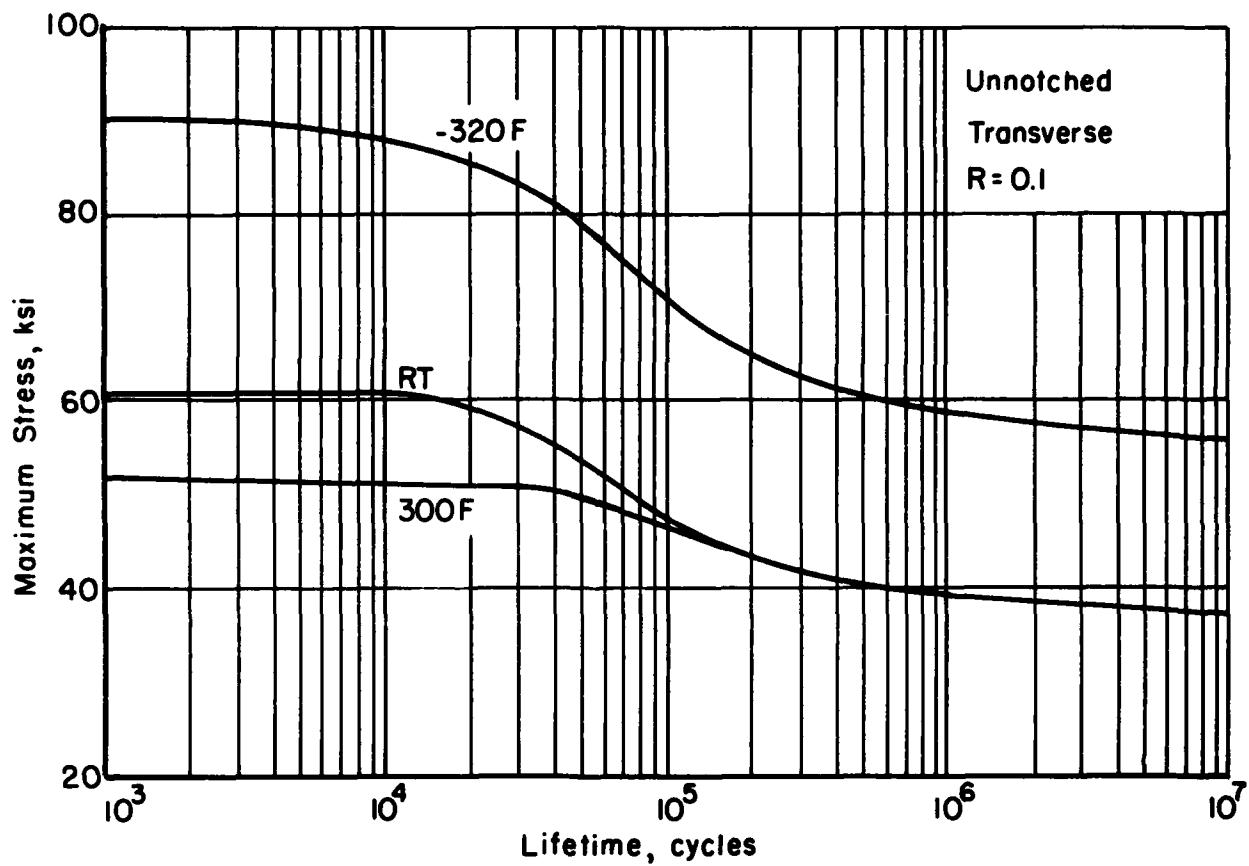


FIGURE 3. AXIAL-LOAD FATIGUE RESULTS FOR 7039-T6151 ALUMINUM ALLOY PLATE

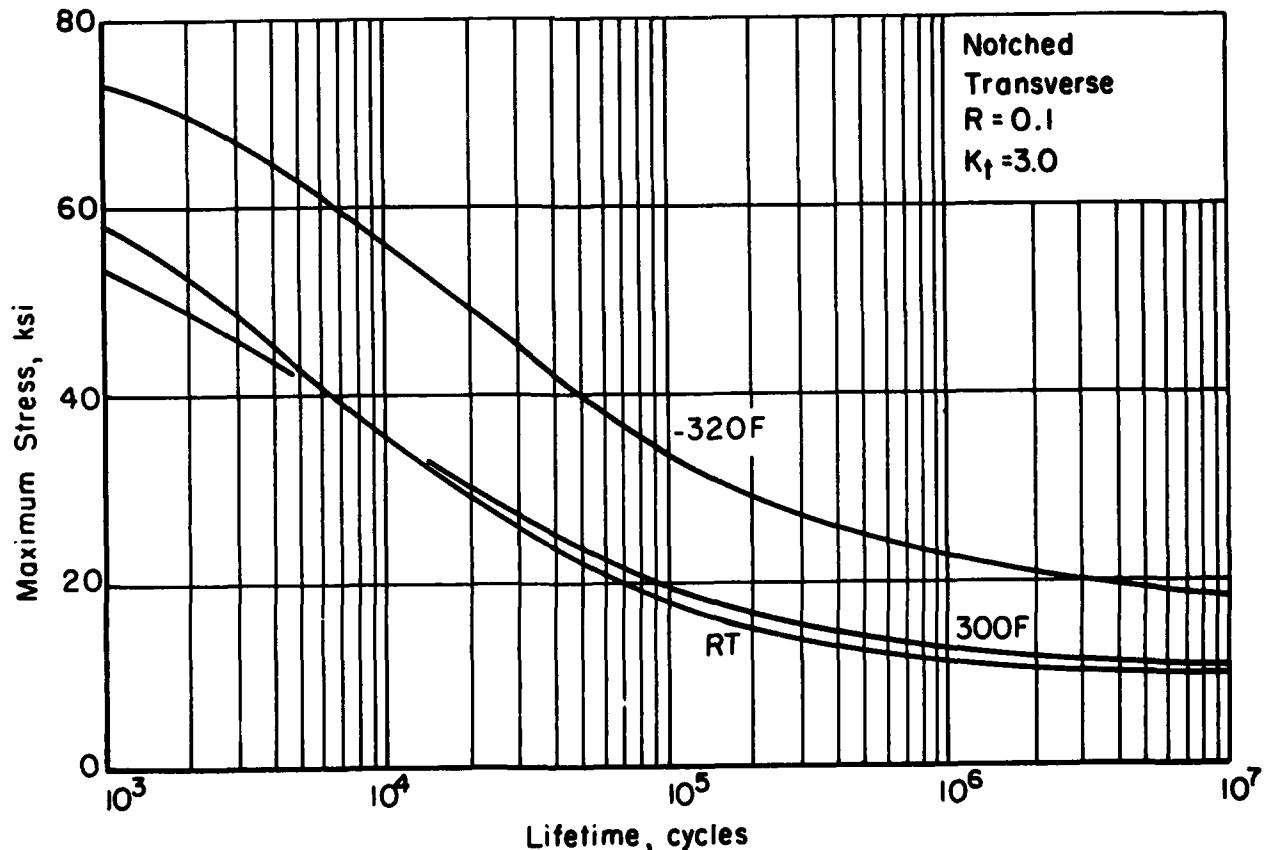
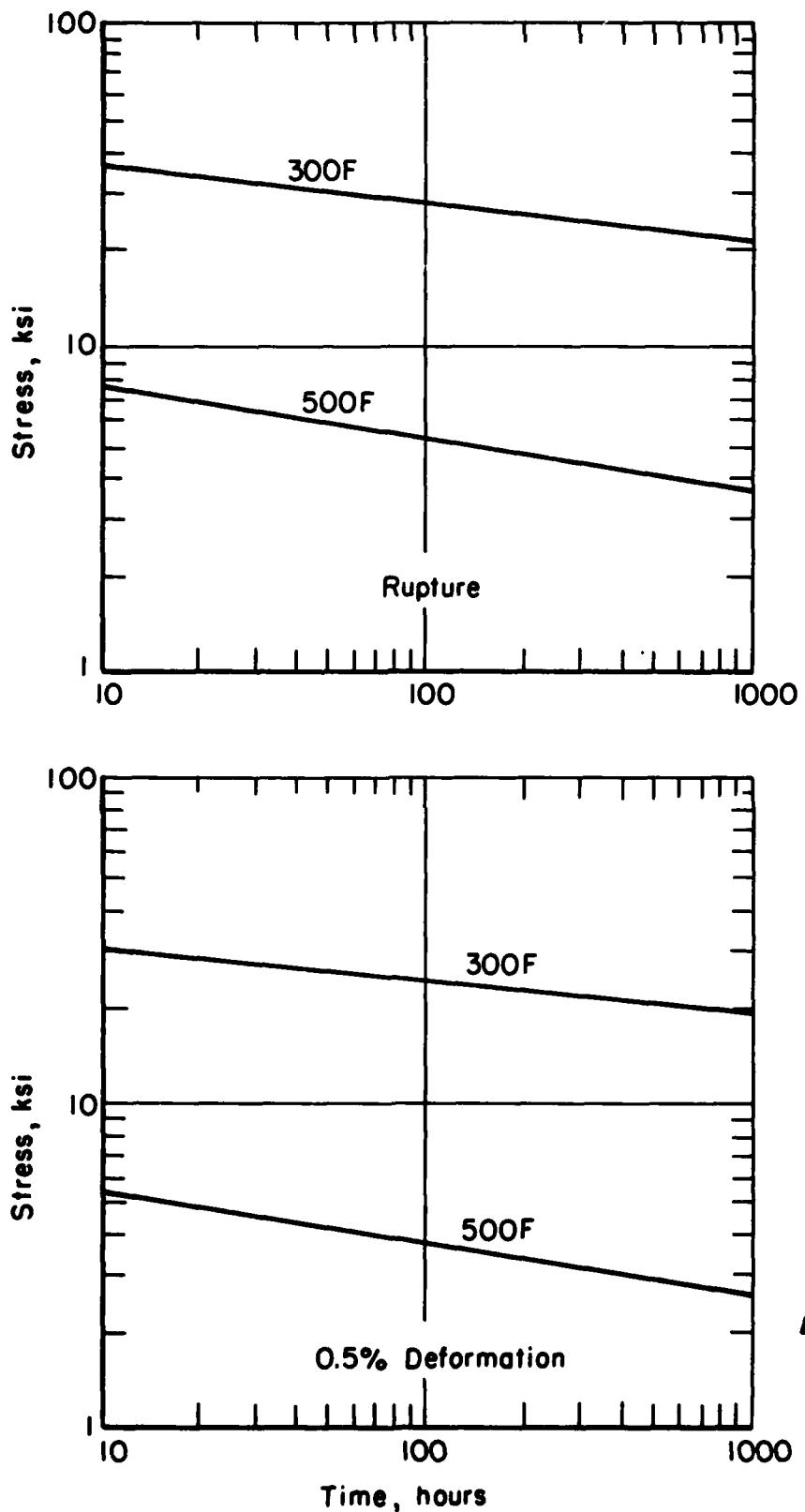


FIGURE 4. AXIAL-LOAD FATIGUE RESULTS FOR NOTCHED ($K_t = 3.0$) 7039-T6151 ALUMINUM ALLOY PLATE



Accession For	
NTIS GRA&I	<input type="checkbox"/>
DTIC TAB	<input checked="" type="checkbox"/>
Unannounced	
Justification	
By _____	
Distribution/ _____	
Availability Codes _____	
Print	Avail and/or Special
	
	

FIGURE 5. STRESS-RUPTURE AND 0.5% DEFORMATION CURVES FOR 7039-T6151 ALUMINUM ALLOY PLATE

REFERENCES

(1) "Aerospace Structural Materials Handbook", ASD TDR 63-741, Vol. II
(December 1963), Supplements dated March, 1965, and March, 1966.